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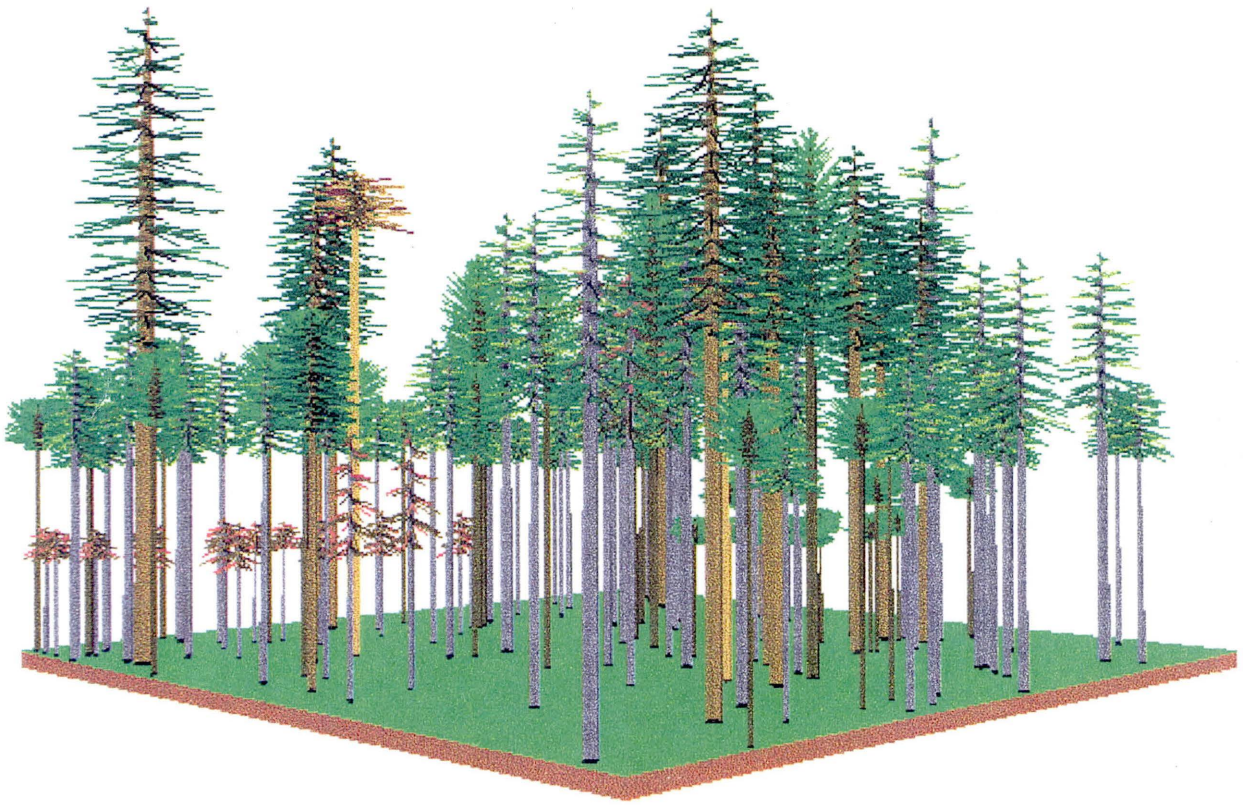
Pine Monitoring in Unit 6
Crabee Timber Sale

Prospect Ranger District
Rogue River National Forest



Southwest Oregon Forest Insect and Disease Technical Center

SWOFIDTC 98-2

Pine Montoring in Unit 6, Crabee Timber Sale
Prospect Ranger District, Rogue River National Forest

Establishment Report (SWOFIDTC 98-2)

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Area and Project Description

Unit 6 of the Crabee Timber Sale is a 30 acre unit located in T40S, R4E, Section 8 (figure 1). The stand on Unit 6 is basically two layered with an overstory composed mostly of ponderosa pine and Douglas-fir and an understory of Douglas-fir and white fir. A few sugar pine, western white pine, incense cedar, and western hemlock occur scattered in the stand. Overstory trees are over 200 years old and many are quite large. Understory trees are mostly 90 years old or less.

The stand in Unit 6 is the only matrix stand in the area that has not experienced significant impacts from past timber harvesting. As a consequence, it has a unique structure and composition. It is possible by viewing the overstory in this stand to visualize what the area must have looked like prior to fire exclusion. The prescription for treatment of Unit 6 has as its aim developing a demonstration area where historic forest conditions are recreated. Treatment will involve harvest removal of all white fir and smaller Douglas-fir while retaining pines, incense cedar, and any Douglas-fir over 25 inches DBH. Large unstocked areas created by the treatment will be planted with pines and incense cedar at wide spacing. The open stand condition and dominance of early seral species created by this prescription will be maintained into the future by use of periodic prescribed burns.

A number of ponderosa pines in Unit 6 have been infested and killed by western and mountain pine beetles (*Dendroctonus brevicomis* and *D. ponderosae*) in recent years. Pine-killing bark beetles have been very active throughout Southwest Oregon in the last two decades. High levels of beetle activity have been attributed to droughty weather conditions and, especially, the extremely heavy stocking that has developed in so many mixed stands with pine components in the region. Ponderosa pines are poor competitors with other trees and are predisposed to bark beetle attack when basal areas around them exceed certain threshold levels. In Southwest Oregon, on moderate to good sites, 180 square feet of surrounding basal area per acre is considered the threshold above which pines become prone to infestation. The dense stand conditions in Unit 6 make it likely that bark beetles will cause substantial future ponderosa pine mortality there unless stocking is reduced. The proposed treatment for the stand is very timely given the desired objective of maintaining pines on the unit in the future.

Pre-Treatment Plot Establishment

In fall 1996 and summer 1997, the Southwest Oregon Forest Insect and Disease Technical Center established a series of monitoring plots in Unit 6 of the Crabee Sale. Purposes of the monitoring are to track the effectiveness of the silvicultural treatment in a) increasing vigor of pine leave trees and b) minimizing infestation of residual pines by bark beetles. Also, effects of prescribed fire on pine leave trees will be evaluated over time.

Fourteen sample points were located systematically along a 3 1/2 by 3 1/2 chain grid across the unit (figure 2). At each point, a variable-radius plot (BAF 20) was established to measure trees per acre and basal area per acre for trees larger than five inches DBH, and a 1/100 acre fixed area circular plot was established to measure numbers of small trees (six inches tall to five inches DBH) per acre. All pines in variable radius plots were tagged and photographed from the plot centers. Photographs are on file at the Southwest Oregon Forest Insect and Disease Technical Center. For each of the tagged pines, data were collected on diameter, surrounding basal area, last 10 year's radial growth, live crown ratio, crown color, needle retention, and width, depth, and circumference of the surrounding duff mound.

Pre-Treatment Conditions

The baseline survey shows the following:

1) Unit 6 currently has a large number of trees and a high average basal area. Our stand exam shows that for the entire stand, average number of live trees $\geq$ five inches DBH per acre is 113.4 and average basal area is 219.9 square feet per acre. There is also an average of 556 small trees (less than five inches DBH) per acre indicating potential for much greater overstocking in the future. Table 1 shows number of trees and basal area per acre broken down by species and size classes. Ponderosa pines make up a substantial stand component but as already noted, are almost all in the larger size classes. Most (91 percent) of the ponderosa pines are 20 inches DBH or greater, and 32 percent have DBHs of 40 inches or greater. Overall, there is an average of 9.7 ponderosa pines per acre with an average basal area of 69.8 square feet per acre. There is almost no evidence of recent natural ponderosa pine regeneration. As previously observed, shade-tolerant firs dominate the understory.

2) Armillaria root disease (caused by the fungus *Armillaria ostoyae*) and annosus root disease (caused by *Heterobasidion annosum*) occur in the northeast, southeast, and central parts of Unit 6 and are causing substantial amounts of white fir mortality. Douglas-fir also is suffering some *A. ostoyae*-caused mortality. Four of the 14 sample plots (29 percent) occur in root disease centers, and in these plots, 42 percent of the firs are infected and 19 percent have been killed. Both *A. ostoyae* and *H. annosum* are fungi that survive for decades in infected roots of stumps or snags and infect new hosts that become established on diseased sites via root contacts or, in the case of *A. ostoyae*, by

growing short distances through soil. Pines and incense cedar are very resistant to *A. ostoyae* and are not affected at all by the form of *H. annosum* that infects white fir. The occurrence of significant amounts of *A. ostoyae* and *H. annosum* in Unit 6 provides an additional rational for favoring pines and incense cedar in the silvicultural treatment.

3) White pine blister rust (caused by the fungus *Cronartium ribicola*) is common and damaging in Unit 6. Virtually all small sugar pines and western white pines encountered in our examination have letahal cankers, and most larger trees in the stand exhibit dead tops and flagging branches caused by white pine blister rust. If five-needle pines are to be included in the future stand on Unit 6, blister rust resistant stock will have to be planted.

4) Past bark beetle-caused mortality of ponderosa pine in Unit 6 has been significant. Twelve percent of the pines were killed by western and mountain pine beetles over the past 20 years.

5) The data suggest that the still-living ponderosa pines in Unit 6 are currently at high risk of bark beetle attack and will become progressively more so if stocking control is not instituted. Eighty percent of the ponderosa pines in the sample plots have surrounding basal areas of 180 square feet per acre or greater. Also, pine growth rates reflect high levels of competition with neighboring trees. Average growth for the sample pines during the last 10 years was only 6.8/20 inches, and 81 percent of the trees exhibited 10 year growth rates of less than 10/20 inches.

6) In spite of old age and slow growth rates, most overstory pines in Unit 6 exhibit healthy-looking, full crowns with good color and needle retention. Average live crown ratio for pines in sample plots is 36 percent and average crown diameter is 21 feet. Hopefully, good crown characteristics indicate that pines will be able to respond to release.

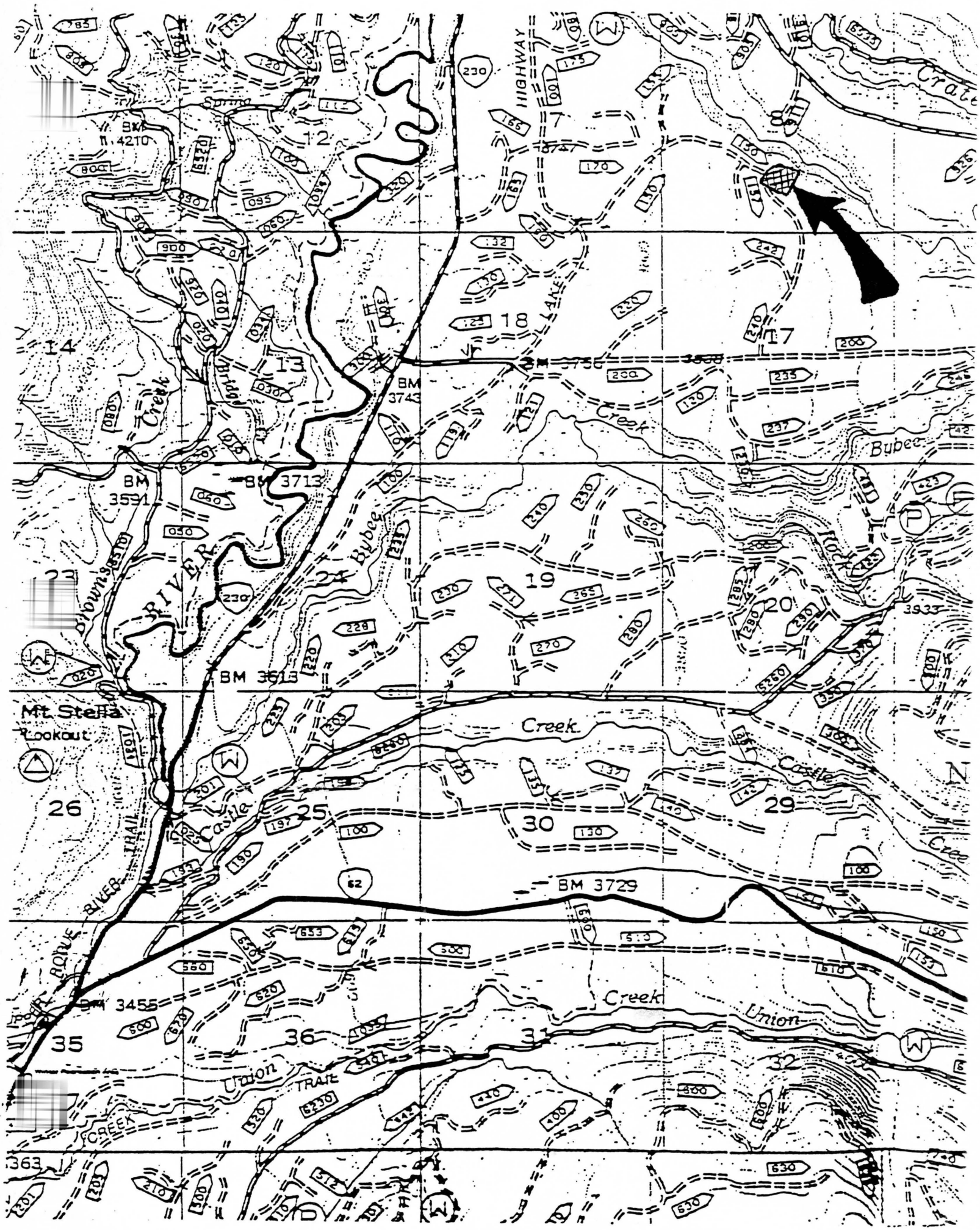
7) All ponderosa pines sampled in Unit 6 have substantial duff mounds around their root collars. Duff layers average 30 inches wide and 13 inches deep and in all cases extend completely around the trees. Occurrence of substantial duff mounds around pines suggests that considerable care must be exercised in using prescribed fire in the unit. It has been shown that even light spring fires can become hot enough when burning through duff mounds to kill fine roots of ponderosa pine as well as cambium under the bark at the root collar. This kind of injury can predispose pines to bark beetle infestation.

Future Monitoring

All monitoring plots in Unit 6 of the Crabee Sale will be revisited after the harvest and initial understory treatment. Post-treatment basal areas and trees per acre will be measured. Subsequently, all plots will be visited at two year intervals to monitor incidence of pine mortality, cause of mortality, tree growth rates, changes in crown condition parameters, and amount of ingrowth of small trees around pines. All characteristics, but

especially growth rates and surrounding basal areas, will be compared between trees that become infested and those that do not. Also, level of beetle infestation over time will be compared between Unit 6 and the adjacent untreated riparian reserve. Special efforts will be made to evaluate any impacts of prescribed fire on pine growth and survival. Monitoring will be continued for 20 years.

FIGURE 1. Location of Unit 6 Crabee Timber Sale.



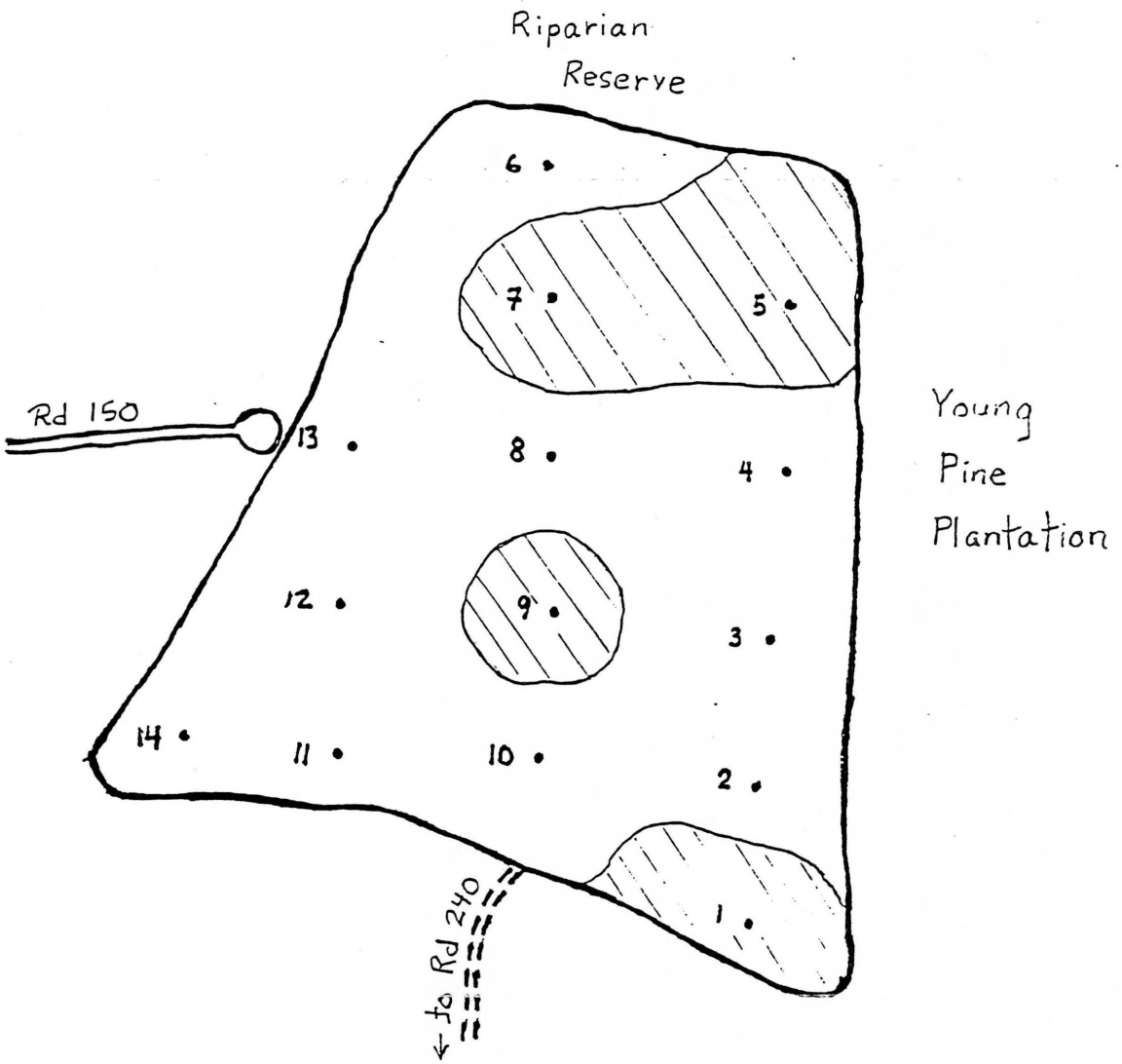


FIGURE 2. Map of Unit 6 Crabee Sale showing location of monitoring plot Cross hatched areas represent root disease centers.

Table 1. Average number of trees/acre and square foot basal area/acre by species and diameter in Unit 6, Crabee Sale.

DBH	White Fir	Incense Cedar	Sugar Pine	Ponderosa Pine	Douglas-fir	All Species
<5	...	...	...	...	...	566.0 (0) [1]
5	0 (0)	0 (0)	0 (0)	0 (0)	10.1 (1.4)	10.1 (1.4)
6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
7	0 (0)	0 (0)	0 (0)	0 (0)	5.7 (1.5)	5.7 (1.5)
8	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
9	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
10	2.5 (1.4)	0 (0)	0 (0)	0 (0)	5.6 (3.0)	8.1 (4.4)
11	6.5 (4.3)	0 (0)	0 (0)	0 (0)	6.4 (4.2)	12.9 (8.5)
12	9.2 (7.2)	0 (0)	0 (0)	0 (0)	3.8 (3.0)	13.0 (10.2)
13	3.0 (2.7)	0 (0)	0 (0)	0 (0)	1.5 (1.4)	4.5 (4.1)
14	5.3 (5.7)	0 (0)	0 (0)	0 (0)	1.3 (1.4)	6.6 (7.1)
15	8.3 (10.2)	0 (0)	0 (0)	0 (0)	1.2 (1.5)	9.4 (11.7)
16	7.4 (10.3)	0 (0)	0 (0)	0 (0)	1.0 (1.4)	8.4 (11.7)
17	2.8 (4.4)	0 (0)	0 (0)	0.9 (1.4)	0.9 (1.4)	4.6 (7.2)
18	2.5 (4.4)	0 (0)	0 (0)	0 (0)	1.6 (2.8)	4.1 (7.2)
19	2.2 (4.3)	0 (0)	0 (0)	0 (0)	0.7 (1.4)	2.9 (5.7)
20	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
21	1.8 (4.3)	0 (0)	0 (0)	0 (0)	0.6 (1.4)	2.4 (5.7)
22	0.5 (1.3)	0 (0)	0 (0)	0 (0)	0.5 (1.3)	1.1 (2.6)
23	0.5 (1.4)	0 (0)	0 (0)	0.5 (1.4)	0.5 (1.4)	1.5 (4.2)
24	0.5 (1.6)	0 (0)	0 (0)	0 (0)	0 (0)	0.5 (1.6)
25	0.9 (3.1)	0 (0)	0 (0)	0 (0)	0 (0)	0.9 (3.1
26	0 (0)	0 (0)	0 (0)	0.4 (1.5)	0.4 (1.5)	0.8 (3.0)
27	1.4 (5.6)	0 (0)	0 (0)	0.4 (1.6)	0 (0)	1.8 (7.2)
28	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
29	1.0 (4.6)	0 (0)	0 (0)	0.3 (1.4)	0 (0)	1.3 (6.0)
30	0.3 (1.5)	0 (0)	0 (0)	0.6 (2.9)	0 (0)	0.9 (4.4)
31	0.3 (1.6)	0 (0)	0 (0)	0.3 (1.6)	0 (0)	0.5 (3.2)
32	0.5 (2.8)	0 (0)	0 (0)	0.5 (2.8)	0 (0)	1.0 (5.6)
33	1.5 (8.9)	0 (0)	0 (0)	0.2 (1.2)	0 (0)	1.7 (10.1)
34	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
35	0 (0)	0 (0)	0.2 (1.3)	0.4 (2.7)	0 (0)	0.7 (4.0)
36	1.0 (7.1)	0.2 (1.4)	0 (0)	0.8 (5.6)	0 (0)	2.0 (14.1)
37	0.6 (4.5)	0 (0)	0 (0)	0.8 (6.0)	0 (0)	1.3 (10.5)
38	0 (0)	0 (0)	0 (0)	0.2 (1.6)	0.2 (1.6)	0.4 (3.2)
39	0 (0)	0 (0)	0 (0)	0.3 (2.5)	0 (0)	0.3 (2.5)
>40 [2]	0.4 (4.6)	0 (0)	0 (0)	3.1 (35.6)	0.7 (8.0)	4.2 (48.2)
Total	60.6 (107.8)	0.2 (1.4)	0.2 (1.3)	9.7 (69.8)	42.8 (39.6)	113.4 (219.9)

[1] Almost all trees less than 5 inches DBH were white firs and Douglas-firs; there were a very few small sugar and western white pines all of which were infected by the white pine blister rust fungus

[2] Largest diameters encountered by species were 48 inches for white fir, 66 inches for ponderosa pine, and 78 inches for Douglas-fir.